
Lead Scientist's Report

Summary: This report includes five items: (1) a summary of an article from *San Francisco Estuary and Watershed Science* on physical and biological conditions in a tidal freshwater slough complex in the upper Delta; (2) a summary of an article from *North American Journal of Fisheries Management* on juvenile salmon survival in the Delta during the years 2010–2015; (3) a summary of a brown bag seminar on Delta smelt reproduction and resilience; (4) an update on the 2018 Bay-Delta Science Conference; and (5) the By the Numbers Report.

Physical and Biological Responses to Flow in a Tidal Freshwater Slough Complex.
Frantzich, Jared; Sommer, Ted; and Schreier, Brian. *San Francisco Estuary and Watershed Science*. April 2018.

Much of the Delta's historical tidal marsh habitat has been lost because of human alterations to the landscape. However, a small amount of tidal freshwater marsh and slough habitat remains in the Yolo Bypass and Cache Slough area. Tidal freshwater marsh habitat has not been as well-studied as brackish and salt marsh habitats, both in the Delta and other estuaries. In regions with larger areas of intact tidal freshwater marsh, these systems are highly productive and offer important food web and habitat support for estuarine species.

Researchers from the California Department of Water Resources (DWR) sought to expand the understanding of physical and biological processes in tidal freshwater slough habitat in the Delta, undertaking extensive studies of the systems from 2011 to 2014. They conducted their research in the Cache Slough Complex (CSC), which is a network of tidal freshwater sloughs and flooded islands in the Northern Delta stretching from Cache Slough to the Yolo Bypass. Researchers found that conditions in the CSC were more variable than in the adjacent Sacramento River for water temperature, salinity, turbidity, acidity, and nutrient concentrations.

Another key finding of the study was that seasonal biological productivity (i.e., phytoplankton growth) was markedly higher in the CSC than in the nearby Sacramento River and other Delta regions. Also, zooplankton densities were higher in the CSC than in other Delta regions. These findings indicate that tidal freshwater sloughs could play an important role in supporting food webs in the estuary. The results of this study highlights areas of focus for restoration design in the Delta as the researchers recommend improving habitat diversity and increasing the potential for enhanced biological production by restoring shallow tidal freshwater habitat.

Survival of Juvenile Fall-Run Chinook Salmon through the San Joaquin River Delta, California, 2010–2015. Buchanan, Rebecca A.; Brandes, Patricia L.; and Skalski, John R. *North American Journal of Fisheries Management*. March 2018.

Historically, a diverse population of Chinook salmon inhabited California's Central Valley region, comprising four distinct runs (representing unique seasonal journeys upstream to spawn). The largest of these runs occurred in the fall and has been the nexus of the ocean salmon fishery in California and southern Oregon. The Central Valley fall-run (FR) Chinook Salmon were listed as a "species of concern" in 2004, following a persistent decline in the number of fish returning to the rivers to spawn. Continually low numbers have resulted in fishery closures in the past.

Survival of FR juveniles through the Delta has been measured since 2002 in an effort to understand the causes of the dwindling salmon population. In this study, researchers from the

University of Washington and the U.S. Fish and Wildlife Service measured juvenile survival from 2010 through 2015. They used acoustic telemetry (transmitting tags and receivers) to track the movement of juvenile hatchery fish through the southern portion of the Delta to estimate survival. During this period, the annual probability of survival through the Delta was estimated to be between 0 to 5 percent. This survival rate during the relatively brief juvenile period is likely too low to sustain the population in this region. Flow conditions during most of the study period were low. However, survival remained low in 2011 with relatively high flow conditions. The researchers concluded that increased river flows alone will not be enough to increase juvenile survival. A management focus on overall habitat quality in the Delta, along with consideration of survival throughout the population's entire life history is needed to improve conditions for this population.

Brown Bag Seminar

***It's Vital: Delta Smelt Reproduction and Resilience* – Lauren Damon, Senior Environmental Scientist, California Department of Fish and Wildlife.**

The Delta Science Program is hosting a three-part seminar series focusing on how research and monitoring performed by the Interagency Ecological Program (IEP) is relevant to decision-making in the Delta. Lauren Damon's brown bag, the second in this series, discussed research on Delta smelt fecundity (ability to produce offspring) and how it applies to the management of the Delta. Endangered Delta smelt are endemic and inextricably linked to the Bay-Delta system.

Damon's research has focused on understanding Delta smelt fecundity through data collected on spawning season, spawning frequency (number of times a fish will spawn during the season), and overall egg production. The IEP Spring Kodiak Trawl is used to survey spawning adult Delta smelt and has been operated by the California Department of Fish and Wildlife (CDFW) since 2002, along with additional sampling efforts that are targeted at other life stages of the smelt. Research teams track smelt spawning by examining the reproductive status of fish caught during the spring survey. Damon and her team determined that the spawning season is typically between February and May and is restricted to a water temperature range of approximately 48–64°F. Delta smelt only live one year but can spawn up to three times within this period. However, spawning frequency depends on the length of the spawning season, which is highly variable from year to year. Further, the number of eggs that a female produces is directly related to body size; bigger fish typically produce more eggs.

All of this information allows scientists and managers to better understand the annual fecundity of Delta smelt and to predict when larval fish will be present in the system—information that is useful for managing the species. Based on her research, Damon concluded that smelt population fecundity could be increased by enhancing growth, which would result in greater overall egg production. Management actions that could result in higher growth and fecundity include increasing food availability via floodplain inundation, habitat restoration, and invasive species suppression.

Update on the 2018 Bay-Delta Science Conference

The 10th Bay-Delta Science Conference will be held at the Sacramento Convention Center September 10-12, 2018. The conference, which attracts approximately 1,000 participants, is a forum for the Delta science and management community to present recent findings to a broad audience of researchers, managers, decision makers, and stakeholders. This year's conference

theme is “Our Estuary at an Intersection.” Intersections are decision points and places where crossroads meet, and the management of the Bay-Delta ecosystem sits at the crossroads of ecology, economy, and society. Navigating the intersection has direct implications for statewide water supply and efforts to improve the aquatic ecosystem for fisheries, recreation, tourism, and ecosystem services.

This year’s conference will feature a plenary session with speakers focusing on adaptive management, 21st century science challenges, social sciences, and science communication. In addition to the plenary, conference events include:

- Oral sessions with ~280 presentations on topics including climate impacts, fish ecology and biology, non-native species, social science, hydrology, restoration, water supply, and more
- Poster sessions and reception with over 150 posters
- Early career-mentor lunch
- Extensive art program
- Student awards for the best oral and poster presentations
- Science communication training

The full program for the conference is now available online, and registration is open at the link below. The deadline for early-bird registration is August 17th while pre-registration will close on September 4th. Please visit the conference website for more information:

<http://scienceconf2018.deltacouncil.ca.gov/>.

By the Numbers

Delta Science Program staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: By the Numbers Summary (report to be provided at the Council Meeting)

Attachment 2: Delta Partners: Interagency Ecological Program and Estuary Monitoring Science

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